CLAIMS

1. An electron source for an X-ray scanner comprising electron emitting means defining a plurality of electron source regions, an extraction grid defining a plurality of grid regions each associated with at least a respective one of the source regions, and control means arranged to control the relative electrical potential between each of the grid regions and the respective source region so that the position from which electrons are extracted from the emitting means can be moved between said source regions.

2. An electron source according to claim 1 wherein the extraction grid comprises a plurality of grid elements spaced along the emitting means.

3. An electron source according to claim 2 wherein the emitting means comprises an elongate emitter member and the grid elements are spaced along the emitter member such that the source regions are each at a respective position along the emitter member.

4. An electron source according to claim 2 or claim 3 wherein the control means is arranged to connect each of the grid elements to either an extracting electrical potential which is positive with respect to the emitting means or an inhibiting electrical potential which is negative with respect to the emitting means.

5. An electron source according to claim 4 wherein the control means is arranged to connect the grid elements to the extracting potential successively in adjacent pairs so as to direct a beam of electrons between each pair of grid elements.

6. An electron source according to claim 5 wherein each of the grid elements can be connected to the same electrical potential as either of the grid elements which are adjacent to it, so that it can be part of two different said pairs.

7. An electron source according to claim 5 or claim 6 wherein the control means is arranged, while each of said adjacent pairs is connected to the extracting potential, to connect the grid elements to either side of the pair to the inhibiting potential.

8. An electron source according to claim 7 wherein the control means is arranged, while each of said adjacent pairs is connected to the extracting potential, to connect all of the grid elements not in the pair to the inhibiting potential.

9. An electron source according to any of claims 2 to 8 wherein the grid elements comprise parallel elongate members.

10. An electron source according to claim 9 when dependent on claim 3 wherein the emitting member extends substantially perpendicularly to the grid elements.

11. An electron source according to any of claims 2 to 10 wherein the grid elements comprise wires.

12. An electron source according to claim 3 or any foregoing claim dependent thereon wherein the grid elements are planar and extend in a plane substantially perpendicular to the emitter member so as to protect the emitter member from reverse ion bombardment from the anode.

13. An electron source according to any of claims 2 to 12 wherein the grid elements are spaced from the emitting means by a distance approximately equal to the distance between adjacent grid elements.

14. An electron source according to any foregoing claim further comprising a plurality of focusing elements arranged to focus the beams of electrons after they have passed the grid.

15. An electron source according to claim 14 wherein the focusing elements are elongate.

16. An electron source according to claim 14 or claim 15 when dependent on claim 2 wherein the focusing elements are parallel to the grid elements.

17. An electron source according to claim 16 wherein the focusing elements are aligned with the grid elements such that electrons passing between any pair of the grid elements will pass between a corresponding pair of focusing elements.

18. An electron source according to claim 17 wherein the focusing elements are spaced at equal intervals to the grid elements.

19. An electron source according to any of claims 14 to 18 wherein the focusing elements are arranged to be connected to an electric potential which is positive with respect to the emitter.

20. An electron source according to claim 19 wherein the focusing elements are arranged to be connected to an electric potential which is negative with respect to the grid elements.

21. An electron source according to any of claims 14 to 20 wherein the control means is arranged to control the potential applied to the focusing elements thereby to control focusing of the beams of electrons.

22. An electron source according to any of claims 14 to 21 wherein the focusing elements comprise wires.

23. An electron source according to any of claims 14 to 22 wherein the focusing elements are planar and extend in a plane substantially parallel to the direction in which the source regions are arranged to emit electrons so as to protect the emitter means from reverse ion bombardment from an anode.

24. An electron source according to claim 4 or any foregoing claim dependent thereon wherein the grid elements are spaced from the emitter such that if a group of one or more adjacent grid elements are switched to the extracting potential, electrons will be extracted from a length of the emitter member which is longer than the width of said group of grid elements.

25. An electron source according to claim 24 wherein the grid elements are spaced from the emitter member by a distance which is at least substantially equal to the distance between adjacent grid elements.

26. An electron source according to claim 24 or claim 25 wherein the grid elements are spaced from the emitter member by a distance of the order of 5mm.

27. An electron source according to claim 26 wherein the grid elements are spaced from the emitter member by a distance of approximately 5mm.

28. An electron source according to any of claims 24 to 27 wherein the grid elements are arranged to at least partially focus the extracted electrons into a beam.

29. An electron source according to claim 1 wherein the source regions are formed on respective emitting members which are electrically insulated from each other and the control means is arranged to vary the electric potential of the emitting members to control said relative electric potentials.

30. An electron source according to claim 29 wherein the grid is arranged to be held at a constant potential.

31. An electron source according to claim 30 further comprising focusing elements which are also arranged to be held at a constant potential.

32. An electron source according to claim 31 wherein the focusing elements are arranged to be held at the same potential as the grid.

33. An electron source according to claim 31 or claim 32 wherein the focusing elements are arranged such that there is one focusing element between, but spaced forwards from, each adjacent pair of emitter members.

34. An electron source according to any foregoing claim wherein the control means is arranged to activate each of the source regions in turn.

35. An electron source according to any foregoing claim wherein the control means is arranged to control the electric potentials of the source regions or the grid regions so as to extract electrons from a plurality of

successive groupings of said source regions each grouping producing an illumination having a square wave pattern of a different wavelength.

36. An X-ray tube comprising an electron source according to any foregoing claim and at least one anode.

37. An X-ray tube according to claim 36 wherein the at least one anode comprises an elongate anode arranged such that beams of electrons produced by different grid elements will hit different parts of the anode.

38. An X-ray scanner comprising an X-ray tube according to claim 36 or claim 37 and X-ray detection means wherein the control means is arranged to produce X-rays from respective X-ray source points on said at least one anode, and to collect respective data sets from the detection means.

39. An X-ray scanner according to claim 38 wherein the detection means comprises a plurality of detectors.

40. An X-ray scanner according to claim 38 or claim 39 wherein the control means is arranged to control the electric potentials of the source regions or the grid regions so as to extract electrons from a plurality of successive groupings of said source regions each grouping producing an illumination having a square wave pattern of a different wavelength, and to record a reading of the detection means for each of the illuminations.

41. An X-ray scanner according to claim 40 wherein the control means is further arranged to apply a mathematical transform to the recorded readings to reconstruct features of an object placed between the X-ray tube and the detector.

42. An X-ray scanner comprising an X-ray source having a plurality of X-ray source points, X-ray detection means, and control means arranged to control the source to produce X-rays from a plurality of successive groupings of the source points each grouping producing an illumination having a square wave pattern of a different wavelength, and to record a reading of the detection means for each of the illuminations.

43. An X-ray scanner according to any of claims 38 to 41 wherein the source points are arranged in a linear array.

44. An X-ray scanner according to claim 43 wherein the detection means comprises a linear array of detectors extending in a direction substantially perpendicular to the linear array of source points.

45. An X-ray scanner according to claim 44 wherein the control means is arranged to record a reading from each of the detectors for each illumination.

46. An X-ray scanner according to claim 45 wherein the control means is arranged to use the readings from each of the detectors to reconstruct features of a respective layer of the object.

47. An X-ray scanner according to claim 46 wherein the control means is arranged to use the readings to build up a three dimensional reconstruction of the object.

48. An X-ray scanner comprising an X-ray source comprising a linear array of source points, and X-ray detection means comprising a linear array of detectors, and control means, wherein the linear arrays are arranged substantially perpendicular to each other and the control means is arranged to control either the source points or the detectors to operate

in a plurality of successive groupings, each grouping comprising groups of different numbers of the source points or detectors, and to analyse readings from the detectors using a mathematical transform to produce a three-dimensional image of an object.

49. An X-ray scanner according to claim 48 wherein the control means is arranged to operate the source points in said plurality of groupings, and readings are taken simultaneously from each of the detectors for each of said groupings.

50. An X-ray scanner according to claim 48 wherein the control means is arranged to operate the detectors in said plurality of groupings and, for each grouping, to activate each of the source points in turn to produce respective readings.

51. An electron source substantially as hereinbefore described with reference to Figures 1 to 5, Figures 6 and 7, Figures 8 and 9, Figure 10, Figure 11, Figure 12, Figures 12a, 12b and 12c, Figures 13, 14a, 14b and 14c, or Figure 15 of the accompanying drawings.

52. An X-ray tube substantially as hereinbefore described with reference to Figures 1 to 5, Figures 6 and 7, Figures 8 and 9, Figure 10, Figure 11, Figure 12, Figures 12a, 12b and 12c, Figures 13, 14a, 14b and 14c, or Figure 15 of the accompanying drawings.

53. An X-ray scanner substantially as hereinbefore described with reference to Figures 1 to 5, Figures 6 and 7, Figures 8 and 9, Figure 10, Figure 11, Figure 12, Figures 12a, 12b and 12c, Figures 13, 14a, 14b and 14c, or Figure 15 of the accompanying drawings.

54. An electron source according to claim 29 wherein the emitting members comprise emitter pads supported on an insulating emitter block.

55. An electron source according to claim 54 further comprising a layer of conductive material formed on the insulating block to provide electrical connection to the emitter pads.

56. An electron source according to claim 55 wherein the emitter pads are applied onto the layers of conductive material.

57. An electron source according to any of claims 54 to 56 further comprising a heating element adjacent to the emitter block.

58. An electron source according to claim 57 wherein the heating element comprises a block of insulating material with a layer of conductive material applied to it forming a heating element.

59. An electron source according to any of claims 54 to 58 further comprising a connecting element providing electrical connections for each of the emitter pads and flexible connecting elements providing electrical connections between the connecting element and the emitter block.

60. An electron source according to claim 59 wherein the connecting elements are arranged to accommodate relative movement of the connecting element and the emitter pad caused by thermal expansion.